



Conserve 0 Gram

July 1993

Number 2/3

Arsenic Health And Safety Update

Background

From the 18th century to the mid-20th century, arsenic compounds were commonly applied to biological specimens to prevent insect infestation. Arsenic in the form of soap mixtures and sprays was applied to bird and mammal skins and mounts. Arsenic also was used as a fixative in the preparation of wet specimens to control the growth of micro-organisms. Once applied to a specimen, arsenic tends to adhere strongly to hair and feathers. Arsenic retains its toxicity for a long time. In general, the older the specimen, the greater the likelihood that arsenic will be present. Specimens containing arsenic compounds can never be fully decontaminated. Accordingly, curatorial staff must exercise precautions in handling biological specimens collected and prepared before the middle 1950s.

National Park Service museum collections may contain arsenic-treated natural history specimens that pose a health risk to curatorial staff and to the public, especially researchers, unless proper precautions are taken. Curatorial staff must take steps to identify arsenic compounds that may be on specimens and to develop procedures for the proper handling of these specimens. This **Conserve 0 Gram** provides guidance on how to test museum objects for the presence of arsenic and to implement handling, storage, and use precautions.

Health Related Effects'

Route of Entry: Skin absorption, inhalation, and ingestion.

Organs Affected: Stomach and intestines, heart and blood vessels, kidney, nervous system, and skin; liver in laboratory animals.

Acute (short-term) Effects: Nausea, vomiting, diarrhea, weakness, loss of appetite, coughing, chest pain, giddiness, headache, and breathing difficulty.

Chronic (long-term) Effects: Weakness, nausea, vomiting, diarrhea, skin and eye irritation, hyperpigmentation, thickening of the palms and soles, contact dermatitis, warts, ulceration and perforation of the nasal septum, and numbness and weakness in the legs and feet.

Carcinogenic Effects: A potential human carcinogen; may cause cancers of the skin, lungs, and lymphatic system.

Reproductive Effects: Causes malformations in the offspring of laboratory rats, mice, and hamsters.

Handling, Storage, and Use Precautions

Generally, unless confirmed to be safe, treat all specimens prepared through the mid-1950s as though they were prepared with arsenic or other toxic compounds. Any exhibited specimens from this period should be enclosed in an exhibit case. Such specimens should **never** be used in hands-on interpretation.

- Handle contaminated specimens as little as possible. Never touch specimens with bare skin. Wear latex gloves and a protective smock or apron. Wear a respirator fitted

with high-efficiency particulate air (HEPA) filters. If possible handle specimens by their stands or mounts.

- Always discard gloves and wash hands after working with the specimens. Keep lab smocks and aprons clean. Do not wash them with other fabrics.
- Obtain a Material Safety Data Sheet on arsenic (available from the Regional Curator) and keep it in the park's curatorial workspace or office. (See Conserve 0 **Gram 2/1.**)
- Label museum specimen cabinets housing specimens suspected of or known to be contaminated with arsenic with a warning sign that indicates **ARSENIC**. Prepare and post a written set of instructions for handling contaminated specimens. Consult the Material Safety Data Sheet for further information.

Procedures for Identification of Arsenic

1. **Inspect specimens in the collection.** Look for powdery or crystalline deposits at the base of feathers and hairs, around eyes, in or at the base of ears, around mouth or bill, along ventral incision, at base of tail, and on foot pads. Even if deposits are not evident, all specimens collected and prepared before the mid-1950s should be tested for the presence of arsenic. In addition to examination, where possible study the specimen's history. Try to determine when and by whom it was collected and prepared to see if preparation information can be located.
2. **Test specimens for arsenic.** A test kit has been developed by EM Science (a Division of EM Industries, Inc.) to detect the presence of arsenic. At this time, the only vendor for the kit is VWR Scientific. Use of this kit requires no elaborate setup or special equipment. Each kit contains the supplies and equipment necessary to conduct 100 individual tests. Additional supplies needed are 1 molar solution potassium hydroxide (KOH), a glass dropping bottle (with a polypropylene screw cap, rubber bulb, and glass pipet), a metal microspatula, and extra reaction vessels to facilitate multiple tests.
- 3 **Instructions for use of the kit.** The directions for use supplied with the kit were written by the manufacturer for testing a water sample for the presence of arsenic, and not specifically for museum specimens.

Instead of using the directions provided with the kit, follow these modified instructions:
 - As outlined in **Conserve 0 Gram 2/1**, obtain, read, and keep on file a Material Safety Data Sheet (MSDS) for each chemical used in the test. At the time of purchase, request these sheets from the vendor. **Read the contact hazard label on the lid of the kit. Conduct the test in a well-ventilated workspace. Wear protective latex gloves, apron, and safety glasses.**
 - For each test, obtain a sample from the specimen. If a residue is evident, use the tip of a metal microspatula to remove the crystalline or powdery material and place it in the reaction vessel. If there is no obvious residue, use a cotton swab dampened with distilled water to collect a sample from the base of hair or feathers or from crevices of the skin. Cut off the swab fibers and use them as the test sample. Place the sample in the kit's reaction vessel. Use a glass dropping bottle to dispense the KOH. Add one to two drops of the KOH to dissolve the sample. If results of the first test do not indicate arsenic, collect and test samples from other areas of specimen (see item #1 above), as the arsenic compound may have not been evenly applied.
 - Affixed to one end of each plastic test strip is a white reagent impregnated blotter swatch. Holding the swatch area of the test

strip downwards, insert the strip into the slit in the reaction vessel's cap. Ensure that the cap divides the test strip into two approximately equal segments (one inside and one outside).

- Put 1 measuring spoonful (spoon provided in the kit) of zinc dust (container marked Reagent 1) into the reaction vessel.
 - Using the syringe included with the kit, add 10 drops of hydrochloric acid (in the container marked Reagent 2) into the reaction vessel and immediately close the vessel with the cap.
 - Allow the reaction vessel with contents to stand for 30 minutes. At end of the test time, remove the test strip. Immerse it briefly in tap water. Compare any change of color on the swatch with the color scale provided on the vial containing the test strips.
- 4. Tag specimens testing positive for arsenic.** Write chemical symbol for arsenic, As, prominently on the specimen's label. Retain complete records of each test, whether positive or negative, in the specimen's accession or catalog folder.
- 5. Specimens prepared before the mid-1950s may still contain arsenic,** even though they do not show residue or test positive. They should be inspected and tested every 2 to 3 years, as arsenic may migrate from the interior of the specimen.
- 6. Inform the Park Safety Officer and the Regional Curator about the project and the results.**

Cleaning the Reaction Vessel(s)

The test results in formation of precipitate material in the reaction vessel. The procedures for cleaning the vessel(s) are as follows:

1. Use tap water to rinse the precipitate material out of the vessel. Rinse the vessel several times. Ensure that the precipitate and water from all rinsings are dumped into a sealable, impervious container.
2. Use small amount of isopropyl alcohol in a final rinse of the vessel. The alcohol acts as a drying agent.
3. Dispose of the container and contents in accordance with the park's Hazardous Waste Disposal Program. Contact the Park or Regional Hazardous Waste Coordinator for disposal guidance.
4. The container **must** be labeled as containing hazardous waste. Information on the label must include the name of the active ingredient of waste material. Consult the Park Hazardous Waste Coordinator for instructions on proper interim storage of container.

Note

1. "Occupational Safety and Health Guideline for Inorganic Arsenic and Its Compounds," Informational Newsletter 1, No. 1 (Bedford, MA: ESA Laboratories, Inc., 1988).

Sources

Arsenic test kit (cat. no. EM 10026-1) is available from VWR Scientific, P.O. Box 626, Bridgeport, NJ 08014, (609) 467-2600.

One molar KOH is available in minimum quantities of one pint from VWR Scientific and Fisher Scientific, 711 Forbes Avenue, Pittsburgh, PA 15219, (412) 562-8300. Glass dropping bottles and metal microspatulas may be obtained from these same vendors.

Shell vials may be used as additional reaction vessels. They can be obtained from Southern Biological Supply Company, P.O. Box 368, McKenzie, TN 38201, (800) 748-8735. (Stock #S8849; 12 dram capacity.)

Protective equipment (e.g., respirator, gloves, apron, and safety glasses) are available from a variety of sources, including Lab Safety Supply Company, P.O. Box 1368, Jamesville, WI 53547, (800) 356-0783.

Reference

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Leather Conservation News Vol. 2, No. 2.

Austin, Texas: Materials Conservation Laboratory, Texas Memorial Museum, 1986.

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Formerly issued as Conserve 0 Gram 2/6 Revised 1993.

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